

WHAT IS CLAIMED IS:

1. A seal apparatus for sealing a portion of a fluid vessel, said apparatus comprising:

an inflatable and collapsible enclosed structure constructed and arranged to transition between an inflated configuration and a collapsed configuration when pressurized fluid is received therein and released therefrom, respectively; and

at least one seal member protruding from an outer surface of said enclosed structure,

wherein said seal member is constructed and arranged to engage an inner surface of the fluid vessel to form a fluid tight seal between said inner surface and said outer surface of said enclosed structure when said enclosed structure is disposed therein and pressurized to substantially the inflated configuration.

2. The apparatus of claim 1, further including a support member disposed within said enclosed structure and fixedly attached to opposing ends thereof, said support member providing support against outward, longitudinal

expansion of said ends when said enclosed structure is in substantially in the inflated configuration.

3. The apparatus of claim 2, wherein said support member is made of a flexible material.

4. The apparatus of claim 3, wherein said flexible material is polymeric rope.

5. The apparatus of claim 2, further including a substantially rigid end member disposed at each of said ends of said enclosed structure and connected to a corresponding end of said support member, said end members providing a rigid wall portion to support said corresponding ends of said enclosed structure against outward, longitudinal expansion when in substantially said inflated configuration.

6. The apparatus of claim 5, wherein when said enclosed structure is in substantially said inflated configuration, said enclosed structure generally forms a cylindrical body having a longitudinal axis, said structural support

member being disposed generally along said longitudinal axis and said end members disposed transverse to said longitudinal axis.

7. The apparatus of claim 1, wherein said at least one seal member is integrally formed with said structure.

8. The apparatus of claim 1, wherein said at least one seal member has a semi-toric cross-section.

9. The apparatus of claim 1, wherein said at least one seal member is fixedly attached to said outer surface of said enclosed structure.

10. The apparatus of claim 9, wherein said at least one seal member is made of a rubber material.

11. The apparatus of claim 1, wherein an outer surface of said seal member is coated with a lubricant layer.

12. The apparatus of claim 1, wherein said enclosed structure is constructed and arranged so that when in substantially said inflated configuration,

said outer surface thereof includes at least one radially protruding portion having an annular, proximal end.

13. The apparatus of claim 12, wherein said at least one seal member is mounted at the proximal end of said radially protruding portion.

14. The apparatus of claim 13, wherein said seal member is integrally formed with said enclosed structure.

15. The apparatus of claim 1, wherein said enclosed structure is made of a flexible polymeric material.

16. The apparatus of claim 1, wherein said enclosed structure is integrally formed.

17. The apparatus of claim 1, further including at least one first valve fixedly attached to said enclosed structure, said at least one first valve being adapted to receive pressurized fluid for inflating said enclosed structure.

18. The apparatus of claim 17, wherein said first valve is adapted to release said pressurized fluid from within said structure.

19. The apparatus of claim 17, further comprising at least one second valve, wherein said second valve is adapted to release said pressurized fluid from within said structure.

20. The apparatus of claim 1, wherein said fluid vessel has substantially a circular cross-section.

21. The apparatus of claim 20, wherein said enclosed structure in substantially said inflated configuration has substantially a circular cross-section.

22. The apparatus of claim 21, wherein said seal member is annular.

23. The apparatus of claim 1, wherein said pressurized fluid includes a pressurized gas.

24. The apparatus of claim 1, wherein when said enclosed structure is pressurized, said enclosed structure is adapted to expand longitudinally within said fluid vessel and forcibly drive contents therefrom by the longitudinal expansion thereof, said enclosed structure being adapted to expand to a volume that is smaller than the volume of the vessel when expanded longitudinally.

25. The apparatus of claim 24, wherein an end of said enclosed structure is adapted to be fixedly attached to said fluid vessel.

26. The apparatus of claim 1, wherein when said enclosed structure is pressurized, said enclosed structure is adapted to expand longitudinally within said fluid vessel and forcibly drive contents therefrom by the longitudinal expansion thereof, said enclosed structure being adapted to expand to a volume that is substantially the same as the volume of the vessel when expanded longitudinally.

27. The apparatus of claim 26, wherein an end of said enclosed structure is adapted to be fixedly attached to said fluid vessel.

28. A fluid vessel, comprising:  
a vessel body having a wall bounding an interior space for receiving a fluid;  
an inflatable and collapsible enclosed structure slidably disposed within said interior space, said enclosed structure being internally pressurized by a second fluid to an inflated configuration,

at least one seal member provided on an outer surface of said enclosed structure and engaged with an inner surface of said wall to provide a fluid tight seal therebetween.

29. The fluid vessel of claim 28, further including a support member disposed within said enclosed structure and fixedly attached to opposing ends thereof, said support member providing support against outward, longitudinal expansion of said ends when said enclosed structure is in substantially in the inflated configuration.

30. The fluid vessel of claim 29, wherein said support member is made of a flexible material.

31. The fluid vessel of claim 30, wherein said flexible material is polymeric rope.

32. The fluid vessel of claim 29, further including a substantially rigid end member disposed at each of said ends of said enclosed structure and connected to a corresponding end of said support member, said end members providing a rigid wall portion to support said corresponding ends of said enclosed

structure against outward, longitudinal expansion when in substantially said inflated configuration.

33. The fluid vessel of claim 32, wherein when said enclosed structure is in substantially said inflated configuration, said enclosed structure generally forms a cylindrical body having a longitudinal axis, said structural support member being disposed generally along said longitudinal axis and said end members disposed transverse to said longitudinal axis.

34. The fluid vessel of claim 28, wherein said at least one seal member is integrally formed with said structure.

35. The fluid vessel of claim 28, wherein said at least one seal member has a semi-toric cross-section.

36. The fluid vessel of claim 28, wherein said at least one seal member is fixedly attached to said outer surface of said enclosed structure.

37. The fluid vessel of claim 36, wherein said at least one seal member is made of a rubber material.



38. The fluid vessel of claim 28, wherein an outer surface of said seal member is coated with a lubricant layer.

39. The fluid vessel of claim 28, wherein said enclosed structure is constructed and arranged so that when in substantially said inflated configuration, said outer surface thereof includes at least one radially protruding portion having an annular, proximal end.

40. The fluid vessel of claim 39, wherein said at least one seal member is mounted at the proximal end of said radially protruding portion.

41. The fluid vessel of claim 48, wherein said seal member is integrally formed with said enclosed structure.

42. The fluid vessel of claim 28, wherein said enclosed structure is made of a flexible polymeric material.

43. The fluid vessel of claim 28, wherein said enclosed structure is integrally formed.

44. The fluid vessel of claim 28, further including at least one first valve fixedly attached to said enclosed structure, said at least one first valve being adapted to receive pressurized fluid for inflating said enclosed structure.

45. The fluid vessel of claim 44, wherein said first valve is adapted to release said pressurized fluid from within said structure.

46. The fluid vessel of claim 44, further comprising at least one second valve, wherein said second valve is adapted to release said pressurized fluid from within said structure.

47. The fluid vessel of claim 28, wherein said fluid vessel has substantially a circular cross-section.

48. The fluid vessel of claim 47, wherein said enclosed structure in substantially said inflated configuration has a substantially circular cross-section.

49. The fluid vessel of claim 28, wherein said fluid vessel includes at least one of a tank and a pipe.

50. The fluid vessel of claim 49, wherein said tank and said pipe have substantially a circular cross-section.

51. The fluid vessel of claim 50, wherein said enclosed structure in substantially said inflated configuration has a substantially circular cross-section.

52. The fluid vessel of claim 28, wherein said seal member is annular.

53. The fluid vessel of claim 28, wherein said second fluid includes a gas.

54. The apparatus of claim 28, wherein when said enclosed structure is pressurized, said enclosed structure is adapted to expand longitudinally within said fluid vessel and forcibly drive contents therefrom by the longitudinal expansion thereof, said enclosed structure being adapted to expand to a volume that is smaller than the volume of the vessel when expanded longitudinally.

55. The apparatus of claim 54, wherein an end of said enclosed structure is adapted to be fixedly attached to said fluid vessel.

56. The apparatus of claim 28, wherein when said enclosed structure is pressurized, said enclosed structure is adapted to expand longitudinally within said fluid vessel and forcibly drive contents therefrom by the longitudinal expansion thereof, said enclosed structure being adapted to expand to a volume that is substantially the same as the volume of the vessel when expanded longitudinally.

57. The apparatus of claim 56, wherein an end of said enclosed structure is adapted to be fixedly attached to said fluid vessel.

58. A method for sealing a portion of a fluid vessel, said fluid vessel including a vessel body having a wall bounding an interior space for receiving a fluid, said method comprising:

disposing an inflatable and collapsible enclosed structure in a deflated or partially inflated configuration within said interior space;

inflating said enclosed structure to an inflated configuration so as to engage at least one seal member provided on the outer surface of said enclosed structure with an inner surface of said wall to provide a fluid tight seal therebetween.

59. The method of claim 58, further comprising:

deflating said enclosed structure to substantially a collapsed configuration.

60. The method of claim 59, further comprising removing said enclosed structure from said fluid vessel.

61. The method of claim 58, further comprising:  
pressurizing the fluid vessel with a gas of sufficient pressure to cause translation of said enclosed structure within said fluid vessel.

62. The method of claim 58, further comprising:  
expanding said enclosed structure longitudinally within said fluid vessel to forcibly drive contents therefrom by the longitudinal expansion thereof.